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Attorney Docket No. 14017-1

REMARKS

Claims 1 to 41 are pending in the Application. Claims 2, 3, 14 to 38, and 40 are withdrawn pending allowance of any generic claims. Claims 1, 4-13, 39, and 41 are rejected. In view of the following remarks, Applicants respectfully submit that this application is in condition for allowance. Accordingly, reconsideration and a timely indication of allowance are respectfully requested.

Applicants' invention is for an electroosmotic flow controller that controls fluid flow through a combination of electroosmotic flow (EOF) and pressure driven flow (PDF). In effect, flow control is provided by varying the degree of electroosmotic "assist", either in the positive or negative direction, to the pressure driven flow through the channel. An advantage of Applicants' invention is that rapid and accurate flow control can be affected over a wide range of flow rates, both high and low. Further, the flow controller can be used in microscale devices with few or no moving parts and the devices will be compatible with most solvents.

Withdrawn Claims 2, 3 and 14 to 38, and 40

The Examiner states that claims 2, 3, 14 to 28 and 40 are drawn to an invention nonelected with traverse in Applicants' response filed May 24, 2004. The Examiner states that a complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action. Applicants respectfully disagree.

Claims 2, 3, and 14 to 36 are species claims dependent from claim 1. Additionally, claims 37 and 38 are species of the device claimed in claim 1. In the Office action mailed on April 22, 2004, the Examiner states that claims 1 and 39 appear to be generic. Moreover, the Office action states that upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim. As Applicants are continuing to argue for patentability of claims 1 and 39 over the references cited by the Examiner, Applicants respectfully submit that claims 2, 3, and 14 to 38 should continue to remain in the application

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as withdrawn claims pending conclusion of prosecution on claims 1 and 39. See 37 CFR §1.141.

The Rejection Of Claims 1, 4 to 13, and 39 Under 35 U.S.C. § 103(a).

The Office has rejected Claims 1, 4 to 13, and 39 under 35 U.S.C. § 103(a) as being unpatentable over Welch et al. (U.S. Patent No. 5,302,264) in view of Paul et al. (US 6,019,882). Applicants respectfully traverse the rejection of independent Claims 1 and 39 and request withdrawal of the rejection and allowance of Claims 1 and 39 and Claims 4-13, depending from Claim 1, based on the following remarks. Applicants respectfully submit that Welch et al. does not remedy the defects of previously cited Rhodes et al. and still fails to teach all of the limitations of claims 1 and 39, either alone or in combination with Paul et al.

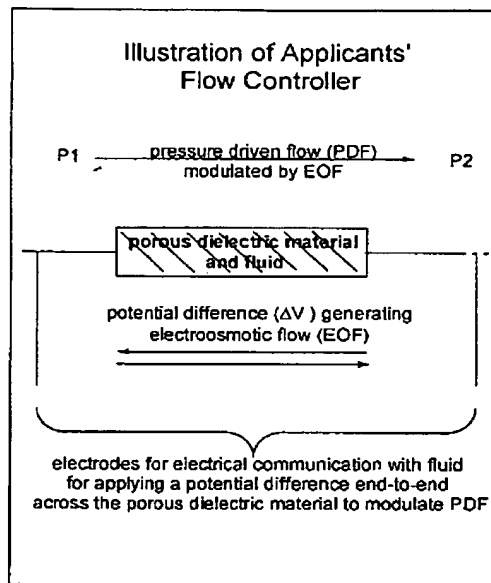
A. The References Do Not Teach Or Suggest All The Claim Limitations.

Independent Claims 1 and 39 are limited, in varying language, to spaced electrodes for applying a potential difference end-to-end across a porous dielectric material within a channel, whereby the potential difference generates an electroosmotically-driven flow component through the channel that modulates a pressure-driven flow component. Neither Welch et al., nor Paul et al., alone or in combination describe this limitation of Applicants' invention. Accordingly, the Office has not established a *prima facie* case of obviousness.

As shown by the following illustration, in Applicants' claimed flow controller and method for controlling a flow of a fluid, an electroosmotic flow (EOF) component is generated, which modulates, that is, adjusts or controls, a pressure driven flow (PDF) component. The flow controller has spaced electrodes for applying a potential difference end-to-end across a porous dielectric material within the channel. The potential difference generates the electroosmotic flow component within the channel, which modulates the pressure driven flow component. As described in the Specification, the electroosmotic flow can be in either direction depending on the nature of the fluid and the dielectric material. (*See, e.g.*, page 9, lines 21-26).

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Welch et al., does not describe Applicant's claimed spaced electrodes for applying a potential difference end-to-end across a porous dielectric material within a channel, whereby the potential difference generates an electroosmotically-driven flow component through the channel that modulates a pressure-driven flow component.

Welch et al. discloses a capillary electrophoretic separation device. A high voltage power supply is connected across a capillary tube by means of an anode and a cathode to supply a high voltage. The voltage causes electrophoretic flow of ions in the mixture sample contained in the capillary tube. (Col. 5, lines 57 to 62). However, the power supply has a simple on/off switch, and cannot be adjusted to alter the electrophoretic flow. (Col. 5, line 68 to Col. 6, line 2; Col. 7, lines 45 to 63). Thus, Welch et al. does not teach an electroosmotically-driven flow component through the channel that modulates a pressure-driven flow component. Rather, the Welch et al. device uses a pressure/vacuum supply system to control sample movement through the capillary tube. (Col. 6, lines 10 to 16). Additionally, Welch et al. does not teach the use of a porous dielectric material within the capillary.

As detailed above, Welch et al. does not teach or suggest Applicants' claim limitation of applying a potential difference end-to-end across a porous dielectric material within a

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channel to generate an EOF, which modulates a pressure driven flow. Paul et. al does not remedy the deficiencies of Welch et al., because Paul et al. does not teach modulating pressure driven flow in a device with an EOF. Accordingly, neither alone nor in combination do Welch et al. and Paul et al. teach or suggest all the claim limitations of independent Claims 1 and 39 and Claims 4-13, depending from Claim 1. Applicants request withdrawal of the rejection and allowance of all pending claims on this basis.

B. There Is No Suggestion Or Motivation To Combine or Modify The References.

A *prima facie* case of obviousness requires a suggestion or motivation to modify the reference or combine the teachings. MPEP § 2143. If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, there is no suggestion or motivation to make the proposed modification. MPEP § 2143.01. The Office has not established a *prima facie* case of obviousness because the proposed modification renders Welch et al. unsatisfactory for its intended purpose. Applicants request withdrawal of the rejection and allowance of all claims on this additional basis.

1. The Proposed Modification Renders Welch et al. Unsatisfactory For Its Intended Purpose.

As stated by the Office, Welch et al. does not disclose “a porous dielectric material disposed in the flow channel”, a limitation of Claims 1 and 39 (Office Action, page 3). The Office cites to Paul et al. to remedy the deficiencies of Welch et al., stating “Paul et al. (‘882) discloses that it is known in the art to provide a porous dielectric material within a flow channel for the purpose of providing a desired permeability within the flow channel.” (Office Action, page 3).

However, combining Welch et al. and Paul et al. renders the device described in Welch et al. unsatisfactory for its intended purpose. The Welch et al. device will not work with a porous dielectric material. Accordingly, there is no suggestion or motivation to make the proposed modification, and the Office has not established a *prima facie* case of obviousness.

The purpose of providing a porous dielectric material disposed within the channel is to create an electroosmotic flow within the channel. Electroosmotic flow within the channel is

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accomplished by filling or saturating the porous dielectric material with an appropriate liquid and applying a potential difference end-to-end across the material. (*See, e.g.*, Specification, page 8, lines 24-28). The degree of permeability of the porous dielectric material is determined by factors such as pore size, topology number, and physical geometry, and is particular to a given application.

The combination of Welch et al. and Paul et al. would render the device described in Welch et al. unsatisfactory for its intended purpose. Welch et al. describes a "capillary electrophoresis" system, which consists of a first reservoir in communication with an inlet end of a capillary tube, the first reservoir being open to the atmosphere. The system also consists of a second reservoir in communication with an outlet end of the tube, the second reservoir being sealed with a septum. (*See, e.g.*, cols. 5-6).

As is known to those of skill in the art, and as described in Welch et al., col. 5, for example, an electrophoretic separation requires that a sample be disposed within the capillary in a buffer. If the porous dielectric material described in Paul et al. were substituted into the capillary electrophoresis system described in Welch et al., the system would not also be able to contain the sample and buffer to perform the electrophoretic separation, and movement of some sample elements would be impeded. Accordingly, since the proposed modification to Welch et al. would render the device unsatisfactory for its intended purpose, *i.e.*, electrophoretic separation, there is no suggestion or motivation to combine or modify the references. Applicants request withdrawal of the rejection and allowance of all claims on this basis.

Additionally, the power source, anode and cathode described in Welch et al. does not modulate flow. Rather, the flow is controlled by an elaborate pressure/vacuum supply system including multiple valves. The electric field in the Welch et al. device is used to separate analytes in a capillary already provided with a pressure driven flow by the pressure/vacuum supply system. One skilled in the art would have no motivation to modify the device of Welch et al. to modulate the pressure-driven flow using an electroosmotically-driven flow as claimed in claims 1 and 39, because Welch et al. is specifically directed to an alternative system for

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directly modulating pressure-driven flow using a pressure/vacuum supply system.

Accordingly, Applicants submit that claims 1 and 39 are patentable over Welch et al. and Paul et al. either alone, or in combination. Claims 4 to 13 depend from claim 1 and by definition contain all of the limitations of claim 1. Therefore, Applicants respectfully submit that claims 4 to 13 are patentable over Welch et al. and Paul et al for the reasons given above regarding claim 1 as well as because of the additional limitations contained therein. For example, Claim 4 recites that the power supply "is a variable power supply." This limitation is neither taught or suggest in Welch et al. which teaches only a power supply having an on/off switch. One skilled in the art would have no motivation to alter the power supply of Welch et al. to vary the amount of current to the anode and the cathode, because the flow is altered by the pressure/vacuum source. Accordingly, Applicants respectfully request that this rejection be withdrawn as to claims 1, 4 to 13 and 39.

The Rejection Of Claim 41 Under 35 U.S.C. § 103(a).

The Office rejected claim 41 under 35 U.S.C. § 103(a) as being unpatentable over Welch et al. (U.S. Patent No. 5,302,264) in view of Paul et al. (US 6,019,882) in further view of Rhodes et al. (U.S. Patent No. 6,004,443). Applicants respectfully traverse this rejection.

Claim 41, as with claims 1 and 39, is directed to spaced electrodes for applying a potential difference end-to-end across said porous dielectric material within a channel, whereby the potential difference generates an electroosmotically-driven flow component through the channel that modulates a pressure-driven flow component. None of these limitations are taught or suggested by Welch et al. As explained above, Paul et al. fails to remedy the defects of Welch et al., because Paul et al. does not teach modulating pressure driven flow in a device with an EOF.

Rhodes et al. fails to remedy the defects of Welch et al. and Paul et al. Rhodes et al. discloses an electrophoretic separation device for chromatographic sample separation in a chamber. The device uses pressure driven flow (PDF) for controllable flow in the column.

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(Col. 7, lines 43-55). An interaction between the charged solute molecules and the chamber walls creates an excess of positive charge, along the liquid-wall interface. The excess positive charge is attracted toward the cathode in the electrophoretic separation, which causes an EOF of liquid along the liquid-wall interface. Rhodes et al. teaches that an imbalance of these flow rates affects sample separation (*e.g.*, distorts the separation sample into a smile or frown). (Col. 8, lines 1-27). Rhodes et al. teaches *neutralizing* flow imbalance, that is, the differences in pressure across the chamber caused by flow imbalance from differing PDF and EOF across the chamber, either through computer control of an applied electric field and/or altering the pump rate (*i.e.*, the PDF rate) to achieve minimum sample dispersion across the chamber, that is, to achieve the desired flat zone of separating sample. (Col. 17, lines 3-16).

To neutralize the flow imbalance in the chamber, Rhodes et al. describes applying an electrical field to one end of the separation chamber. The electrical communication in the device is shown in Figure 5, and is also described in col. 16, line 61 through col. 17, line 16; and col. 18, line 45 through col. 19, line 7. Rhodes et al. fails to teach spaced electrodes for applying a potential difference end-to-end across said porous dielectric material within a channel, whereby the potential difference generates an electroosmotically-driven flow component through the channel that modulates a pressure-driven flow component and thus fails to remedy the defects of Welch et al. and Paul et al.

Claim 41 is further limited to a flow controller having a “sensor” and a “controller connected to the sensor and the power supply to control the electroosmotically-driven flow component by maintaining the control signal within a predetermined range and modulating the electric potential applied by the power supply”. These features are not taught or suggested in any of the cited references.

Accordingly, Applicants respectfully submit that claim 41 is allowable over Welch et al., Paul et al., and Rhodes et al., either alone or in combination. Therefore, Applicants respectfully request that this rejection be withdrawn.

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CONCLUSION

In view of the above remarks, Applicants believe that the application is in condition for allowance. If there are any issues that can be resolved by telephone with the Applicants' representative, the Examiner is encouraged to contact the undersigned directly.

No fees are believed due in connection with this communication. However, the Commissioner is hereby authorized to charge payment of any fees associated with this communication to Deposit Account No. 19-2090.

Respectfully Submitted,
SHELDON & MAK PC

Date: May 10, 2005By: 

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